

5. Note upon Intercentra in the Vertebral Column of Birds.

By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

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The existence of intercentra in the caudal region of the bird's vertebral column has not been much insisted upon. The late Prof. Parker, in the course of some remarks on the intercentra of birds¹, observes that they are to be met with in the posterior half of the caudal series in the Cygnet, and in the Cormorant where they are not so numerous. Dr. Gadow, who has said the last published word on this matter, states, in the 'Dictionary of Birds'², of the caudal vertebræ that "they articulate almost entirely by the centrum, which has slightly heterocelous or concave facets, with the interposition of a fibro-cartilaginous disk, the ventral side of which frequently displays in embryos, but rarely in the adult, a median osseous nodule, the last remnant of the basi-ventral elements commonly called the intercentrum." Prof. T. J. Parker³ refers to two intercentra in the vertebral column of the adult *Apteryx* in the caudal region, and there are a few scattered references to the same structures in the writings of Shufeldt⁴ and others. Thus Prof. Parker⁵ refers to their existence in *Opisthocomus*.

My experience is directly contrary to that of Dr. Gadow; I find intercentra plentiful in the adult skeletons of many birds, belonging to different groups, in the caudal region⁶. It may be useful to state briefly the main facts which the collection of birds at my disposal in the Society's Gardens has enabled me to ascertain. A few previous records of the facts I refer to in footnotes. A few general remarks, which are in effect an abstract of those facts, may perhaps be made first. I use in the following pages the two terms "intercentra" and "hypocentra." By the former is to be understood free nodules or pieces of bone lying between the centra and only (at most) articulated with the adjoining centra. By the latter expression the hypophyses, hypapophyses, or hæmapophyses of authors, which are apparently downward processes of a given vertebra (apparently, but not really) like those which are so often, particularly among diving birds, found upon the cervical and dorsal vertebræ. It is necessary to use two words for these structures, because they are not in every case absolutely the same.

¹ "On the Vertebral Chain of Birds," Proc. Roy. Soc. 1888, p. 474.

² Article "Skeleton," p. 856.

³ "Observations on the Anatomy and Development of *Apteryx*," Phil. Trans. 1891.

⁴ "Comparative Osteology of Arctic and Subarctic Water-Birds," J. Anat. Phys. 1889, p. 20.

⁵ "On the Morphology of a Reptilian Bird, *Opisthocomus cristatus*," Tr. Z. S. vol. xiii. (1891) p. 63.

⁶ Marshall, "Beobachtungen über den Vogelschwanz," Nederl. Arch. f. Zool. i. p. 194, describes and figures intercentra in the caudal region of the young of several birds.

The hypocentra—as may be seen in various species with free intercentra—are intercentra which are attached to the summit of short outgrowths of the centra. Thus the coalesced hypapophysis is really intercentrum *plus* this median central outgrowth. In several cases where there are no free intercentra, but only the hypocentra, it would be difficult to assert that the latter are really, as has been stated, partly produced by the intercentral discs of bone. They appear to belong so entirely to the centrum. But that this is not the case can be readily seen from such examples as that shown in the drawing (woodcut, fig. 1), where the free intercentra gradually come to be more and more thoroughly articulated with the centrum behind.

The intercentra when present as free structures appear invariably to increase in size from before backwards. They often begin as little more than mere granules of bone, which, as they are often easily detachable, may have been missed, though really present. They are especially loosely attached, and therefore liable to be lost, in the Anks.

So far as can be judged from the facts which are briefly stated in the following pages, the existence of free intercentra is not universal but very general among birds. There are, however, groups, such as the Cuckoos and Columbæ, in which these structures are not present as independent bonelets. There are also some birds in which they do not appear to exist at all; in which, indeed, there are no hypapophyses which may be presumed to be these structures, but this is rare.

They are obviously most prevalent in water-birds, including, however, the land Limicolæ, which are so nearly akin to the Gulls and Anks. They are rarest among arboreal birds, such as Parrots, Pigeons, Picarian and Passerine birds; but occur in the possibly archaic *Opisthocomus*. In the reduced tail of the *Struthiones* intercentra do not occur plentifully. Parker, as has been already mentioned, finds two in *Apteryx*. But Mivart¹, in his elaborate description of the axial skeleton of the *Struthiones*, does not appear to have met with them. There does not appear to be a very definite connection between the presence of intercentra and the lowness of the place of the bird in the series; but, on the other hand, there does, with some exceptions, seem to be some relationship between the length of the tail and the existence of free intercentra. It is not known to what extent these structures existed in most of the important types of extinct birds; but Marsh found two free intercentra in *Hesperornis*².

ANSERES.

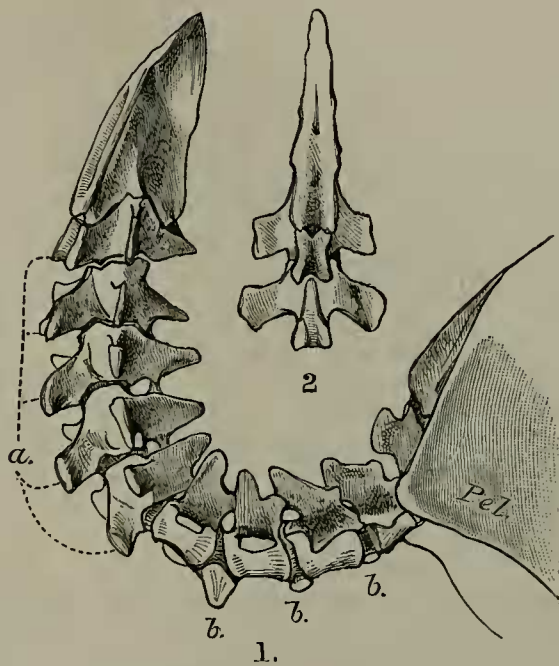
In *Biziura lobata* (fig. 1) the intercentra are especially well developed. There is a small oval nodule 3 mm. long between the last sacral and the first free caudal, a rather larger one between this and the following vertebra, and in the next interval a large

¹ "On the Axial Skeleton of the Ostrich," Zool. Trans. viii.; and "On the Axial Skeleton of the *Struthionidæ*," *ibid.* x.

² See his great work upon the "Odontornithes." Washington, 1880.

somewhat conical intercentrum. The five following intercentra are "hypocentra"—that is to say, they are completely ankylosed

Fig. 1.



Caudal vertebrae of *Biziura lobata*. 1, lateral view; 2, from below.

Pel., pelvis; *a.*, hypocentra; *b.*, free intercentra.

with the centra; a lateral notch only remains to prove their distinctness from the centra.

In *Tachyeres cinerea* there is a granule of bone only to represent the first intercentrum of *Biziura*; the two next vertebrae have short hypocentra, these increase in the three next; between the 6th and the 7th is a free conical intercentrum mainly attached to but not ankylosed with the last free caudal.

Sarcidiornis carunculata, which has five free vertebrae behind the last, which has acquired an attachment to the pelvis, has two free conical intercentra lying between nos. 3/4 and 4/5.

In *Fuligula rufigula* there is an ankylosed hypocentrum on the fourth free caudal. In the two remaining free vertebrae in front of the pygostyle the intercentra are not ankylosed.

Plectropterus gambensis has a minute nodule between the first and second free caudals, and four hypocentra upon the remaining vertebrae, ankylosed.

In *Bernicla brenta* there are minute nodules between C. 1 and C. 2 and between C. 2 and C. 3, but no hypocentra beyond.

PALAMEDEE.

In *Chauna derbiana* there are four free caudals. There are four intercentra which increase in size.

TUBINARES.

So far as my experience goes, all the Tubinares possess free intercentra in the caudal region; but my experience is not of many species.

In *Diomedea melanophrys* there are 6 free caudal vertebræ. There is a minute osseous granule in front of the first of these. Then follow four intercentra increasing in size, and a single hypocentrum; the latter is perforated, and is thus a chevron-bone, while the last intercentrum is nearly perforated. In *Procellaria glacialis* there are the same number of intercentra, save that the first (the small bony granule) of *Diomedea* is absent, and that the last two (possibly three) have become hypocentra. The 2nd to the 4th are distinctly bifid, with a tendency for the ends to meet, and thus complete the chevron. *Fregetta* and *Thalassidroma* have also intercentra.

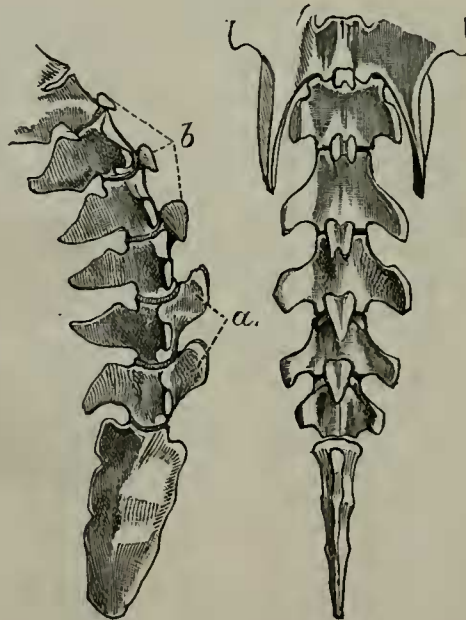
STEGANOPODES.

The only Steganopode in which I have found free intercentra is *Phaethon*. There are here three, gradually increasing in size and lying between the first and fourth free caudals. They are followed by three hypocentra, bifid at the apices.

COLYMBI.

In *Colymbus septentrionalis* (fig. 2) there are five vertebræ between

Fig. 2.



Colymbus septentrionalis. Lateral (left-hand figure) and ventral aspects of caudal vertebræ.

(Lettering as in fig. 1.)

the last which is embraced by the ilia and the pygostyle. There are good-sized intercentra, increasing in size between the last sacral and the first three of these. The last two free caudals have fused hypocentra.

Æchmophorus major has six such vertebræ. There is a minute intercentrum between 1 and 2, and three larger intercentra between the following ones.

HERODIONES.

Among the Herodiones free intercentra are not at all general.

In *Dissura maguari* I only found one lying between the 3rd and 4th free caudals. The skeleton, however, was incomplete, though I feel sure that there were no intercentra in front of this point.

In *Platalea leucorodia* there are large intercentra between the 4th and the 5th, and between the 5th and the last free caudals. In *Pl. ajaja* the last of these was alone present and partly fused with the 6th vertebra. But one in front may have been lost, as they are easily detachable.

Ardea cinerea has no free intercentra, but three progressively increasing hypocentra on the last three free vertebræ. *Butorides cyanurus* has the same and, in addition, a minute free intercentrum. *Cancroma* has three intercentra, increasing in size from a very minute nodule, and a single hypocentrum.

In *Xenorhynchus senegalensis* I found no intercentra at all; in *X. australis* there was a large flattened (compressed) intercentrum between the last two free caudals; this is in contact, but not fused, with the hypocentra of the pygostyle. There are five free caudals in *Tantalus leucocephalus*; between the 2nd and 3rd and the 3rd and 4th are free intercentra; the 5th has a hypocentrum. *Scopus umbretta* has no free intercentra; the last two vertebræ have hypocentra¹.

GRUES.

Neither in the Cranes proper nor in *Psophia*, *Rhinochetus*, and *Eurypyga* are there any free intercentra. But in *Chunga burmeisteri* there are two pairs of small nodules of bone underlying the small pygostyle, which are possibly the equivalents of those structures.

LIMICOLÆ.

Contrary to what we find among the Grues, the Limicolæ have constantly free intercentra. In *Numenius femoralis* there are 8 caudal vertebræ; a minute nodule of bone lies between the centra of the first two of these vertebræ, a slightly larger one between the third and fourth, and a larger one still between the two following. The remaining vertebræ have hypocentra. In *Hematopus* there are also three free intercentra. *Edicnemus gallinarius* has

¹ In *Balaniceps* (Parker, "On the Osteology of *Balaniceps*," Tr. Zool. Soc. iv. p. 335) there is "a small distinct 'sesamoid' bone lying between the second and third centrum."

two fair-sized free intercentra followed by two hypocentra. I found exactly the same number of intercentra and hypocentra in *Thinocorus rumicivorus*. In *Chionis alba* there are 8 free caudal vertebræ, the fifth bears a small hypocentrum; then follow two free good-sized intercentra, of which the last is divided by a suture into two parts. Finally, there is a large bifid hypocentrum.

Intercentra are also present in the Laridæ. In *Stercorarius antarcticus* there are three small round button-shaped intercentra increasing in size from before backwards, followed by two large bifid hypocentra.

RALLI; OTIDES.

So far as I have been able to ascertain, neither the Ralli (including *Helionis*) nor the Otides possess free intercentra.

COLUMBÆ.

The same remark may be made concerning the Pigeons.

ACCIPITRES.

In *Dryotriorchis spectabilis* there is one free nodule of an intercentrum lying between the first two free caudals; the remaining vertebræ have strong hypocentra, which are bifid at the tip. In other Hawks there are no free intercentra, but always hypocentra, which are constantly bifid at the tip and sometimes chevrons.

PSITTACI.

I have found no free intercentra in any Parrot, but always a certain number of hypocentra, which may or may not be bifid at the tip.

OPISTHOCOMI.

In a skeleton of the Hoatzin there are three free intercentra gradually increasing in size, and two hypocentra following them.

GALLI.

Intercentra appear to be rare in this group of birds. I found no free intercentra anywhere, and only hypocentra on the last two caudals of *Aburria carunculata*¹.

CUCULI.

In no Cuckoo that I have examined have I found any free intercentra. But in all there are two or three hypocentra on the last free caudals; one or more is usually a chevron-bone, *i. e.* perforated.

¹ In *Crax globicera*, however (Parker, "On the Osteology of Gallinaceous Birds, &c.," Tr. Zool. Soc. v. p. 169), there are two free intercentra ("hypophyses").

TINAMI.

Among the Tinamous I have not seen free intercentra.

ALCÆ.

Among the Auks intercentra are quite as general as among their near allies the Limicolæ.

In *Uria troile* there are no less than 6 free intercentra, which lie well below the level of the centra and are but loosely attached, so that they would be very readily detachable. There are two of these bony nodules lying side by side between the ultimate and

Fig. 3.



Fratercula arctica. Ventral aspect of caudal vertebræ, showing free intercentra.

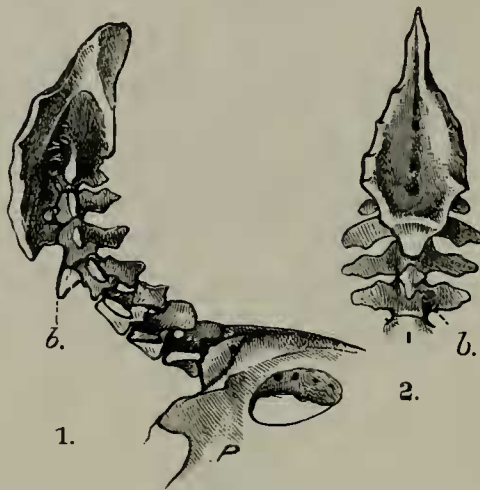
penultimate free caudal. In *Fratercula arctica* (fig. 3) there are 6 very distinct and rather larger intercentra, which are not so loosely attached as are those of *Uria*; in *F. corniculata* I found only five.

PICO-PASSERES.

In this extensive group of Birds free intercentra are infrequent and, when present, not numerous. There are, however, frequently hypocentra, which may have the form of chevron-bones. In *Triponax feddeni*, for example, the last four free caudals bear double hypocentra, the free ends of which become fused in the last two, thus forming chevrons. In *Hylomanes gularis* there is one free intercentrum followed by two hypocentra. *Dacelo gaudi-chaudi* has two free intercentra and five hypocentra. I could not find intercentra in *Coracias*, *Upupa*, *Megascala*, *Halcyon*, *Merops*, *Rhamphastos*, *Colius*. In *Momotus lessoni* there are two distinct intercentra and two hypocentra. Among Hornbills, on the other

hand, free intercentra appear to be the rule. I have found one

Fig. 4.



Toccus erythrorhynchus. Caudal vertebræ. 1, lateral view; 2, ventral view.
P, pelvis; b, free intercentrum.

or two of considerable size. In the Passeres I have never yet met with these structures.

May 18, 1897.

Prof. G. B. HOWES, F.Z.S., in the Chair.

Mr. Sclater exhibited a plan of the new Zoological Garden attached to the "Museu Paraense de Historia Natural e Ethnographia" at Pará, in Brazil, of which Dr. Emil Goeldi, C.M.Z.S., was Director; and called attention to the description of it and its contents recently published in the 'Zoologische Garten' (Jahrg. xxxviii. No. 4, April 1897), by Herr Meerwarth, Assistant in the Pará Museum.

Mr. Sclater exhibited a skin of a Penguin received by him in exchange from the Musée d'Histoire Naturelle of Paris as an example of *Microdyptes serresianus* (Oust.), and read the following note from Mr. Ogilvie-Grant on the subject:—

"I have carefully examined the specimen of so-called *Microdyptes serresianus*, and find it is without any doubt the young of *Eudyptes chrysocome* (Forst.). The shape of the bill and soft downy grey feathers of the throat point at once to its being an immature bird. In the Rothschild Museum at Tring there is a fine series of young *E. chrysocome* in different stages, and with some of these *M. serresianus* is identical."

Mr. R. E. Holding exhibited and made remarks upon a skull of the Theban Goat, *Capra hircus*, var. *thebaica*, a hornless variety of the domesticated Goat peculiar to North Africa and Egypt, which presented a curious shortening of the anterior portion of the skull, the premaxilla and maxilla being considerably reduced. The nasal bones, curved, and separated throughout their entire length from these bones, were articulated only with the frontal bone, and exposed the base of the turbinated bones in the interior of the nasal cavity. The lower jaw remaining the normal length, the incisors projected considerably beyond the premaxilla, preventing the animal from obtaining its food by the ordinary method of grazing.



A. Theban Goat.

B. English Goat.

Mr. Holding also exhibited a fine Bulldog's skull and the skull of a Pig which indicated a similar arrest in the development of the anterior portion of the skull, due directly to selective influences.

Mr. Tegetmeier and others took part in a short discussion on this subject.